SCIENCE.

FRIDAY, OCTOBER 3, 1884.

COMMENT AND CRITICISM.

THE reports of agricultural experiment-stations, experimental farms, and similar institutions, form a class of literature which is rapidly increasing in volume, and which, while it contains very much that is (at least from a scientific stand-point) simply trash, also contains much that is of scientific value. In calling attention to a very prevalent fault of such publications, we would not be understood as calling in question their usefulness for the purposes for which they are intended, and still less as lacking in appreciation of the valuable scientific results which many of them contain — usually, it must be confessed, rather sparingly. The fault to which we refer is not one of matter, but of form. It is the lack of any intelligent discussion of the results of experiments; and it makes itself felt most severely, precisely in the cases in which those results are most important scientifically.

What would be thought of an astronomer, who, after observing an eclipse, or a transit of Venus, should present as his report, simply a memorandum of the observations taken, without reducing or discussing them? Yet substantially this is what we find in very many agricultural reports. The experiments have been planned with more or less intelligence and care, and executed with more or less of painstaking accuracy, according to circumstances; but there the experimenter has stopped, apparently forgetting or ignoring that his work is only half done. The experiment planned and executed, there still remains the task of combining and testing the results, so as to detect their fallacies, and bring out what they really teach; in other words, the task of discussion.

That the task of discussion is so often neglected may be due to several causes. Often it is apparent from the tone of the report, that the author has feared the reproach of being a 'theorist,' and has rather ostentatiously confined himself to a bare statement of facts observed. Vague and undisciplined theorizing, and hasty generalizations, are, of course, to be avoided; but these are something very different from sober study and discussion. Facts are good, especially when they teach principles; but he who will have nothing but facts confines himself to the husks of investigation. In other cases one can scarcely avoid the impression that the writer has been too indolent to discuss his results; and in some instances the suspicion is even suggested that he has been overcome by their complexity or unexpectedness.

But, from whatever cause originating, the prevailing fashion of presenting experimental work is to be reprobated. An author has no right to require that his readers make that critical comparison of results which he is too indolent or too incompetent to undertake himself; nor to thrust upon the unscientific public, to whom such reports as we are speaking of are mainly addressed, crude and superficial conclusions as the results of scientific investigations. Indeed, it is to this latter class that the practice is likely to prove most pernicious. The trained scientific man can readily detect the absence of critical discussion, even though he may not feel called upon to supply the lack; but the unscientific reader, who has had no training of this sort, is very likely to accept whatever conclusions his author draws, however inadequate, as expressing the sum of truth upon that subject, or to stand bewildered before a mass of details, with no clear idea of what they prove.

We submit that in neither case is the experimenter fulfilling his duty to his constituents.

When the public funds are to be expended in scientific investigation, the public has a right to demand that the work be put into the hands of those who are not only industrious experimenters, but who are able and willing to test critically the results of their own experiments, and present to the public only results which have endured such testing.

When the president of the geographical section of the British association declared that the Portuguese 'lost colony,' as described by Mr. Haliburton, 'was something quite new to geographers,' he doubtless failed to recall that in 1881 Bettencourt (Descobrimentos . . . do Portugueses, pp. 132–135) printed the grant to Fagundes of March 13, 1521, which is also contained in Do Canto's Memoria historica, p. 90. The whole subject of the discoveries of Fagundes is taken up by those authors, and also by Henry Harrisse in his Cabots, pp. 275–277 (Paris, 1882), and in his Corte-Real, p. 144 and 171 (Paris, 1883). General Lefroy also failed to remember that Ernesto do Canto, the learned antiquary of S. Miguel, one of the Azores — to whom Harrisse acknowledges his indebtedness — discovered among the manuscripts of the Torre do Tombo a *carta* of the 4th May, 1567, relating to the second lost Portuguese colony mentioned by Mr. Haliburton. This document is in Do Canto's Memoria historica entitled Os Corte-Reaes, p. 161 (S. Miguel, 1883); and also in the appendix to Harrisse's Corte-Real, p. 235, where it is stated that it was communicated by Mr. Do Canto. These three books, and others which we have no space to mention at this time, contain documents going to show that those expeditions actually sailed, and also contain the commissions and confirmations granted the Corte-Reals, their contemporaries and successors, at various times.

The occurrence of two light but wide-spread earthquakes within two months in our usually quiet eastern states awakens attention to the absence of any organized attempt to observe them. The chief difficulty in such an attempt would doubtless be the discouragement of waiting through a considerable time without shocks to observe; but this time is not so long as many would suppose, as may be seen by looking over Rockwood's earthquake lists. The only systematic work now undertaken consists in the collection of accidental records by Professor Rockwood and some few other students of the question, and the reporting of ordinary non-instrumental observations from the signal-service stations. This small beginning could be greatly improved if the U. S. geological survey could lend a hand by providing simple seismometers for a moderate number of stations; and would be still further advanced if observers and students of this branch of physical geography would resolve themselves into an earthquake-club, unembarrassed by formal regulations, chiefly with the object of becoming known to one another, and thus insuring the proper collection and collation of their observations. We should be glad to have correspondence on this subject.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Classification of the Mollusca.

In the instructive comments on the 'classification of the Mollusca' by Messrs. Dall and Lankester, *apropos* of Professor Ray Lankester's article 'Mollusca' in the 'Encyclopædia Britannica,' several points are raised concerning which I should be pleased to be better informed.

In the original review by Mr. Dall (*Science*, iii. 730), it is remarked that 'no single instance of a calcified jaw among recent Mollusca occurs;' and in his reply that gentleman adds, that he "should be grateful to Professor Lankester for the name of any recent mollusk having a shelly or even partially 'calcified' jaw" (*Science*, iv. 143). I have long been under the impression that the Nautilidae furnished such an instance. Woodward expressed the belief of malacologists in his statement, that, "in the recent Nautilus, the *mandibles* are horny, but *calcified to a considerable extent*;" and Professor Lankester (*op. cit.* p. 667) says that in the cephalopods ('Siphonopoda') "the jaws have the form of a pair of powerful beaks, either horny or *calcified* (*Nautilus*)." Is there any reason to doubt or dispute the correctness of such and similar statements?

In my 'Arrangement of the families of mollusks' (1871), I admitted as orders of Acephala (otherwise Conchifera, or Lipocephala) the Dimyaria, Heteromyaria, and Monomyaria, but under mental protest. I

was aware of the apparent exceptions signalized by Mr. Dall, and could add extinct forms referred to the Pteriidae or Aviculidae, as well as the Muelleriidae retained among the Dimyaria. The Monomyaria seemed to me, however, to be a natural 'genetic' group, and the Muelleriidae were bimusculose in youth, and their monomyarian characteristics in the adult appeared to be a peculiar teleological adaptation. I am still disposed to believe that the Monomyaria constitute a natural group, although Mr. Dall has good reasons for thinking that, "in fact, there does not at present seem to be any good basis for ordinal divisions in the Lipocephala." What Mr. Dall designates as 'the remarkable characters of the group of Metarrhiptae' seemed to me to furnish as good a basis for an 'order' as any of those that have been used for that purpose: consequently I gave the name as an ordinal designation in 1871.

But the question whether certain groups are of ordinal or minor value is of less moment than the natural subdivision of the class. If the myological peculiarities are not the best criteria, what are?

A view that has had some currency, that the Monomyaria are inferior forms of Acephala, is negatived by both embryological and paleontological evidence. The testimony of both is conclusive that the Monomyaria are derivatives from Dimyaria.

Is it certain that the shell of the Polyplacophora (Chitons) is the exact homologue of the shells of the typical Gastropods? I am acquainted with what has been published of the embryology of the group, but am left in doubt both as to facts and interpretations. At any rate, it is certain that the old views of a close relation between the Polyplacophora and the docoglossate Gastropoda had very little morphological basis.

My gratitude for the excellent article of Professor Lankester impels me to cordially indorse the encomiums of Mr. Dall, while I concur with the critic as to the family arrangement.

Professor Lankester has sometimes been misled, too, by not remembering that the same objects may be called by different names: for instance, he has referred to the 'Rachiglossa (1.1.1, or 1),' a gastropod named '*Pyrula*, Lam. (fig. 38),' but the figure represents a type belonging to the 'Tenioglossa (3. 1. 3),' and repeated thereunder as one of the 'family 4, Doliidæ,' under the name '*Ficula*.' As my eyes light on neighboring names, I may add that the '*Pediculariidae*' and '*Ovulum*' do not fulfil the conditions of the 'Siphonochlamyda,'—'shell always spiral:' they do not have true spires. Professor Lankester has been deceived by false guides. Such lapses are, however, of a kind inevitable in a general work; for it is impossible for one man to verify every statement. THEO. GILL.

A fasting pig.

IN a recent flood (June 26) that visited this neighborhood, Mr. John Aughenbaugh of West Manchester township had five hogs carried away by the water. On Aug. 7 one of them was found under a large heap of driftwood about a mile from the home of Mr. Aughenbaugh. The animal had been securely imprisoned by the timber, and had not eaten any thing for forty-two days. Although very considerably emaciated when released from its prison, it appeared to have no trouble in emptying a crock of thick milk that was offered it. It has since been doing well, and no doubt will soon recover all it lost in flesh. E. F. S.

York, Penn.

A WIDER USE FOR THE LIBRARIES OF SCIENTIFIC SOCIETIES.

To those who are obliged to use the libraries of our smaller colleges, it is often a source of vexation to find that the books one is referred to are wanting. The resources of the colleges are limited, and the amount of money which can be expended for the purchase of new books small, and that small amount often devoted, according to the wishes of the donor, to the class of books least needed. A case in point occurred lately, where a college professor of mathematics was asked to write a short account of the life of Todhunter; and he felt obliged to say that he would be glad to undertake the article, but could not before he had visited the libraries of either New York or Boston, which he hoped to be able to do during his next vacation.

This constant lacking of just the books one needs for his work is most hampering. It is not the *Century*, or the *Harper*, or the latest novel, or the new book of travel, which cannot be had (these find their way into all the odd corners), but it is the specialist's books, a volume of the transactions of some learned society, a scientific journal, or the modern treatises on thermo-dynamics, on electricity, or on biology, which are needed, and which can be found only in a very few of our libraries in the necessary profusion.

A few such libraries have now been collected by our older scientific societies and our larger colleges. The books of the college libraries are for a specific purpose, and find abundant use at the hands of the students and professors. With the societies the matter stands differently. It cannot be denied that one of the original objects of the establishment of these societies was, that, by the publication of their own 'proceedings,' they might, by exchange, gather a collection of books which could not, in the then comparatively poor state of the country, be gathered in any other way, and which were to be for the use of the members, and such favored friends as they might designate.

It has so happened that these societies were established by the small knots of scientific

men gathered about our larger colleges. These colleges have developed, and their libraries have grown more and more valuable; so that the professors no longer find it necessary to go to their academy for books. At the same time the machinery of their long-established organization has grown more effective; and, while many of the members no longer need their society collection of books, the number and value of those added to the shelves each year are constantly increasing. The result is, that in some of our larger cities there are accumulating very considerable libraries of special works which are scarcely used, as they are duplicated at some neighboring college about which those employing such books live.

It is, of course, with regret that one enters such a library, if library it may be called, and sees the new books which are not called for by the former clientage of the collection, but which would eagerly be asked for if the circle of favored outsiders were widened so as to include all properly vouched-for persons who might live within one, two, or three hundred miles, or even more, and who would be willing to pay a small annual fee to defray the expense of sending books to them by mail or express, and for the extra wear, and danger of loss. It is true that such books as could not be readily replaced in case of loss would necessarily be retained from such a wide-spread circulation; but these would be only the older volumes of the various series, and such books as are very generally kept from such extra risks.

The expense of mailing would be considerable; it would average, on volumes of the size of a bound volume of the *American journal of science*, about sixteen cents each way. To this must be added the cost of handling, and some slight charge for the privilege of use. Altogether, the expense of taking out, say, forty books of this class in the course of the year would be in the neighborhood of ten to fifteen dollars, — a charge which could be reduced very materially by sending for the books a number at a time, so that they might be forwarded to advantage by express; the amount named above being the maximum if each book were mailed separately.

That the expense of using a library through the mails would mount up very rapidly is evident; but the facts remain, that there are large libraries of books solely on matters of interest to scientific men, and of vital interest to such men, and that these libraries exist in communities where by duplication they no longer have their former use. It is highly desirable that the books should be put to use; and their owners would probably be glad to arrange some plan by which the scheme of extending the circulation through the mails could be made practicable. It would be of great advantage in perfecting plans, if those who might be benefited would come forward and state their position.

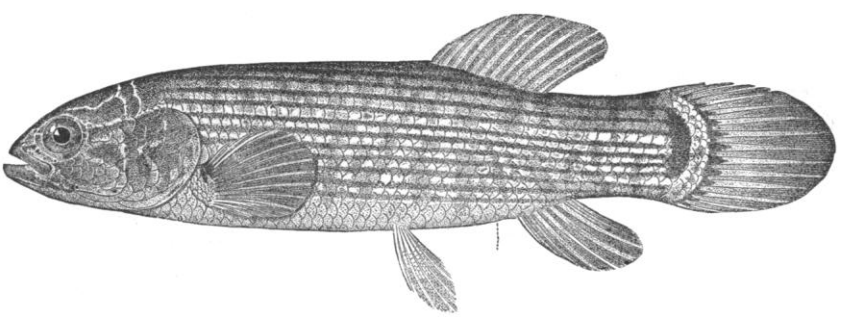
THE COLOR-SENSE IN FISHES.

In his recent volume on 'Mental evolution in animals,'[1] Mr. Romanes remarks, "As further proof that a well-developed sense of color occurs in fish, I may remark, that the elaborate care with which anglers dress their flies, and select this and that combination of tints for this and that locality, time of day, etc., shows that those who are practically acquainted with the habits of trout, salmon, and other fresh-water fish, regard the presence of a color-sense in them as axiomatic." As one 'practically acquainted' with some sixty species of fresh-water fishes, representing a dozen or more distinct groups, I am reminded, by the above quotation, of many occurrences witnessed during my rambles about the Delaware River, or its tributary creeks, that have a bearing upon the subject. Besides recognizing the differences in insects by their colors, have fishes any knowledge of the fact that their own colors may or may not be protective? Are they aware that it depends upon themselves, whether these colors shall be a safeguard, or a source of danger? That we are warranted in giving an affirmative reply, is shown, I think, by their habits, and particularly by the fact that to a certain extent they have the color of their bodies under their control.

Relatively speaking, the fishes of the Delaware River and its tributaries may be classified, in regard to their habits, as diurnal and

[1] Mental evolution in animals, by GEORGE J. ROMANES. New York, *Appleton*, 1884. 411 p. 12°.

nocturnal. It might almost be said that there are no 'fixed' habits. I have found marked variations in every one of the most characteristic habits of our birds; and can see no reason why the same degrees of variability should not likewise obtain among mammals, reptiles, and fishes. In considering fishes as either nocturnal or diurnal, I mean that they are so to about the extent that owls are; i.e., ranging from species as diurnal as hawks to those that are nocturnal, or, properly speaking, crepuscular. How often we hear the phrase, 'as blind as a bat'! yet these mammals are not averse to daylight, and only shun the glare of noonday. In shady woods they are often found insect-hunting by day; and fly just as freely, and range abroad as generally, on cloudy days, as during the gloaming throughout midsummer.



MUD-MINNOW (*Umbra limi*).

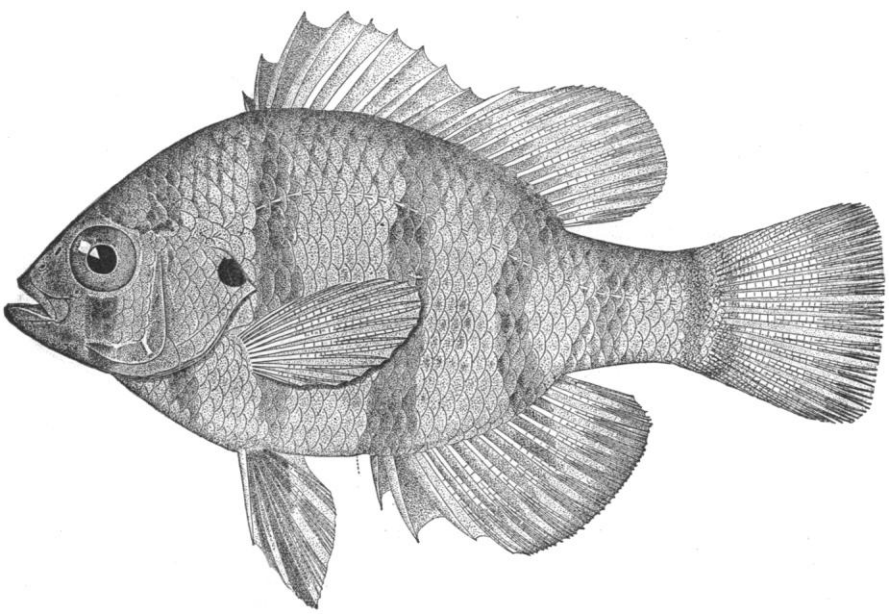
Several years ago, when studying our fishes with reference to detecting supposed traces of voice possessed by them, I concluded that the nocturnal, dull-colored species had the power of uttering certain sounds, especially during the breeding-season; while the diurnal fishes were apparently voiceless, and were dependent upon their gaudy coloration as a sexual attraction. More recent observations have led me a step farther, and I am convinced that the colors of many species continue to play an important part in the struggle for existence throughout the interim from one breeding-season to the next. It must be remembered that fishes, when undisturbed by man's presence, are very different from the frightened animals that rush hither and thither in the most reckless manner when startled by his sudden appearance. We have only to take a favorable position, and, ourselves unseen, to gaze patiently into their accustomed haunts, to realize what animated, cunning, and mentally well-developed creatures fishes really are.

That curious group known as 'darters,' or etheostomoids, is always to be found, when not in motion, resting upon the bottoms of streams; and I have never found these fishes in localities where their color did not closely resemble the sand, mud, or pebbles upon which they rested. I have tested them in this matter in the following manner. Finding a spot in a small stream where many of these fishes congregated, I placed a large number of white-porcelain plates in the stream on a level with the surrounding sand. On disturbing the 'darters,' I found that they invariably settled between these plates, and never on them; and this after the dishes had been several days in position. Finally the currents covered the plates with a thin coating of sand, and then occasionally a 'darter' would come to rest upon one of the plates. The motion of his fins in so doing usually displaced the sand, and exposed the white surface beneath: if so, the fish darted off, and settled between the plates or beyond them. It is evident, I think, that protection through their color must be quite essential to them; more so in the matter of procuring their food, perhaps, than as a safeguard against the attacks of enemies.

The mud-minnow (Umbra limi) depends very largely upon insects and smaller fishes for food, and the question of color is a prominent one in its life history. This fish frequently assumes what we may call an 'inanimate' position, and, with a variety of colors streaking and spotting its sides, has much the appearance of a bit of dead grass, a twig, or a caddis-worm. Often such unnatural positions will be retained for many minutes, or until some object suitable for food comes within reach, when it darts at and seizes it with the rapidity and certainty of a pike. Now, in all such cases, there is great and constant changing of color. Often the tints deepen until the fish appears to be inky-black, then pale until, from above, we can scarcely detect the fish. Such changes, of

course, are very significant, and can only be explained as being serviceable to the fishes in rendering them inconspicuous, both to their enemies and to the wandering animal-life on which they prey. In precisely what way the extreme variations from very dark to pale are serviceable, is not yet known, so far as I am aware; but the fact itself can scarcely be used to the disadvantage of the main proposition, that the color and its changeableness are of benefit to the fish, and are under the animal's control.

I think we have, in the fact that usually they deposit their ova and milt in rapid waters. Waters with a constantly rippling and troubled surface certainly protect them from such enemies as the kingfisher, fish-eating mammals, and probably from frogs and snakes. By drawing a seine through turbulent water at the foot of a mill-dam, I have frequently found scores of splendidly colored cyprinoids; and finally, very soon after spawning, all these extra tints fade out utterly, and the fishes return to their accustomed haunts. These facts



BANDED SUN-FISH (*Mesogonistius chaetodon*).

During the early spring, when the vigor of these fishes is at its maximum, the coloration is more pronounced in every particular; and the continual changing from dark to light, and *vice versa*, as seen in connection with its other habits, shows plainly that it is as much under control as are the folding and spreading of a peacock's tail.

The cyprinoids, or 'shiners,' known collectively as minnows, roach, and dace, so many species of which are conspicuously colored at least at one time of the year, are all essentially diurnal in habit. Their bright colors, as a sexual attraction, are essential to their welfare, but are, at the same time, detrimental to their safety. Have we any reason for believing that these fishes seek to avoid exposure to enemies when thus arrayed in extra-conspicuous dress? certainly seem to indicate that they are aware of the disadvantage of unusually bright colors, which, notwithstanding, are essential to the perpetuation of their kind.

The common banded sunfish (Mesogonistius chaetodon), a silvery-white species, has a remarkable control over the color of the black vertical bands that ordinarily form so conspicuous a feature of the fish. At times when the water is rather clear, and the amount of vegetation not abundant, this sunfish will fade out, and show such ashen, faintly streaked sides, that it might almost pass for a dead leaf; but roused to action by the approach of other fishes, or the finding of food, the dull sides glisten like polished metal, and the faint bands become as black as ebony. Certainly these great and sudden changes are not involuntary. They

cannot be likened to blushing, but are evidently under the fish's control, and are intelligently used to its advantage.

The bony gar (Lepidosteus osseus) is another fish having decided control over the coloration of its scales. When this fish is at rest, the scales are pale blue, with a pink margin; and about the head and gill-covers there is a variety of brilliant hues. At times all these colors will suddenly disappear, and the fish has much more the appearance of a water-soaked stick than of a living animal. Unfortunately I have had too few opportunities for observing this species to determine the reasons for these changes; but it is evident that they are under the control of the fish, and therefore advantageous.

The common pike (Esox reticulatus) also exhibits a variation of coloring, under different circumstances, and suggests the same facts that have already been stated with regard to other species.

When the chief aim of biological science seemed to be the naming and describing of 'species,' it was found that no description of the color of a fish, unless very unusual and marked, was at all satisfactory. Considering the subject of color, as I have in this article, the cause is very evident.

In an early number of *Science*, I offered many reasons for believing that fishes were very far from spending as joyless, machine-like an existence as has been supposed. Those reasons I supplement with the results of studies of their habits, with reference to their brilliant tints and sombre hues, and am in accord with Mr. Romanes when he states that we are justified in regarding 'the presence of a color-sense in them as axiomatic.'

CHARLES C. ABBOTT.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PROCEEDINGS OF THE SECTION OF BIOLOGY.

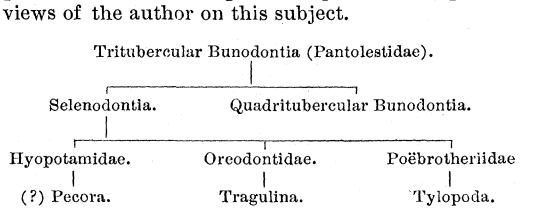
A LARGE number of papers (forty-three in all) were presented before the section of biology, but we regret that in our limited space we can give merely the briefest outlines. The first we may mention was a paper by Mr. H. G. Beyer, on the influence of oxygenated and unoxygenated blood, as well as of blood in various degrees of dilution, on the isolated heart of the frog and terrapin. The paper aimed to prove that it is not concentrated mammalian blood which produces the greatest amount of work done in either the heart of the frog or that of the terrapin, but a certain degree of dilution is necessary. There is no exception in the constant, stimulating influence in oxygenated blood, and none in the depressing effect of non-oxygenated blood.

Dr. C. S. Minot read a paper on biological problems. The author opposed the trinomial system, and considered the present mode of determining species entirely unscientific, and thought that the species should be based on a statistical study of all the variations that are known to occur. Individuals are not always homologous. The only fixed units are, 1° cells; 2° the whole series of generations of cells from a single ovum, — a cell-cycle. An individual may be almost any fractional part of a cell-cycle. Roughly speaking, the higher the organism, the fewer the number of individuals it comprises. The author considered the ovum to be homologous with the encysted protozoon, the zona radiator being equivalent to the capsule or cyst of the protozoon, and the contents also homologous.

In a paper by Lillie J. Martin on a botanical study of the mitegall found on the petiole of Juglans nigra, known as Erineum anomalum Schw., a general survey of the gall was given, as to position, number, general appearance, etc. This was followed by a description and comparison of the microscopical appearance of the gall and normal petiole, concluding with the supposition that the mite entered at an early period in the life of the petiole, and the growth of the gall was from within outward.

A paper by Prof. B. G. Wilder, on the relative position of the cerebrum and the cerebellum in anthropoid apes, was illustrated by photographs, and a preparation of a chimpanzee's brain; conclusively settling the much-disputed point, as to whether the cerebrum extended over the cerebellum or not, as the cerebrum was seen to extend at least a millimetre over the cerebellum.

Mr. E. D. Cope, in a paper on the phylogeny of the artiodactyle Mammalia derived from American fossils, considered the derivation of the seledont dentition from the bunodont as established from a mechanical point of view. The oldest American artiodactyl (Pantolestes) is bunodont. The modification proceeded as in other ruminant lines by the co-ossification of the bones of the legs and feet. The peculiar structure of the carpus in the Oreodontidae shows them to be, without doubt, the ancestors of the Tragulina. The following table represents the present views of the author on this subject.



In a paper on the torsion of leaves, Prof. W. J. Beal stated that he had studied the torsion of leaves produced by the effects of sunlight. Those twisting with the sun are two species of Typha, one species of Sparganium, Acorus, Tritallaria imperialis, and Liatris. Those twisting against the sun are two species of Allium, Iris, Gladiolus, oats, and Setaria. Twisting both ways are Allium cernuum, Phleum, Bromus, barley, Clawson wheat, Panicum, and Zizania. Cyperaceae, Setaria verticillata, S. viridis, and S. italica do not twist at all.

Mr. L. F. Ward read a paper on the fossil flora of the globe; treating the subject from historical, geological, and botanical standpoints.

The two oldest known species (Oldhamia) have been found in the Cambrian of Ireland. From the lower Silurian, 44 species are known, being chiefly marine algae; upper Silurian, 13 species. The ferns predominate among the 188 species known to the Devonian. In the Permo-carboniferous, nearly 2,000 species have been made out, while in the trias 67 are known. In the Rhetic, an advance seems to have been made, which increases to the oölite where 419 species have been found. The upper Jurassic and lower cretaceous are sparingly supplied with vegetal remains. The Cenomanian of Atam, Greenland, and the Dakota group of Kansas and Nebraska, give 500 species. The Turonian again is almost destitute. Senomanian yields 350 species, while the Laramie group of western United States gives 333 species; the tertiary eocene, 800; oligocene, a somewhat larger number, while the miocene gives more than 3,000; the pliocene gives only 150 species.

The first type is that of the Florideae, marine algae. Ferns, Equisetineae and Lycopodineae, appear in the lower Silurian. The Devonian of Canada and Brazil shows us the first appearance of the rhizocarps, while the monocotyledons first appear in the carboniferous. The dicotyledons have their first known representative in the Urogonian of Kome, Greenland. All the leading types of vegetation are introduced without going later down the geological scale than the middle cretaceous. Marine algae predominate in the Cambrian and early Silurian. Ferns flourish in the Permian; Equisetineae and Lycopodineae, in the carboniferous; Cycadaceae, in the lias or oölite; the Coniferae, in the Wealden; monocotyledons, in the eocene; monochlamydeous dicotyledons, in the cenomanian; polypetalous dicotyledons, in the miocene; and the gamopetalous dicotyledons, in the present living flora of the globe. Cellular cryptogams of some kind lived in the Laurentian, and account for the graphite beds there found. Ferns, Equisetineae and Lycopodineae, commenced in the lower Silurian, and had their maximum in the carboniferous. Cycadaceae have their origin in the Devonian, while the maximum is in the middle Jurassic. The Silurian shows the first Coniferae, which reach their maximum in the cretaceous, and then decline. Monocotyledons begin in the lower carboniferous, and have their maximum in the tertiary. Dicotyledons commence in the lower Jura, and the maximum is in the present age.

In a paper on fertility in hybridization, Mr. R. B. Roosevelt cited cases of hybridism between species of Salmonidae, and between Alosa sapidissima and the striped bass. In many cases hybridism greatly improves the species. He proved by an extensive practical knowledge that hybridism in fish at least by no means necessarily implies sterility.

Mr. H. F. Osborne presented observations on the amphibian brain, containing results of microscopic study upon the frog, Menobranchus, Menopoma, and Amphiuma. His method of study was by making series of sections, in three different planes. The relative position of gray and white matter was the same as that found in the spinal cord of these and other vertebrates. The course of the principal nerve-bundles extending from the medulla forward to the hemispheres was described, showing the course of the transverse commissures, and a commissure hitherto overlooked in the roof of the third ventricle was pointed out. This demonstrated that each brain segment had its own dorsal commissure. The differences of the cerebellum in the Anura and Urodela were pointed out, and the resemblances of the latter to the mammalian brain were dwelt upon. The pia blood-vessels are all sent in upon the anterior face of the pituitary body. The pineal elements were shown to consist of certain very inconspicuous foldings of the epithelium of the roof of the third ventricle, which have been generally overlooked. These foldings represent what remains of the stalk of the pineal gland.

Mr. S. Garman's paper on Chlamydoselachus, the frilled shark, treated of the internal anatomy of this peculiar shark. The nearest forms are Notidanidae, Hexanthus, and Heptanchus. Hind and fore brain resemble that of foetal sharks; the cartilage is soft; the lateral line is open as in foetal sharks, and continued to the end of the tail. The pelvis is twice as long as broad: the nearest resemblance to this is seen in the foetal Heptanchus.

The next paper was by Mr. E. D. Cope, on the mammalian affinities of saurians of the Permian epoch, and referred to the detection of mammalian resemblance between Theromorpha and reptiles of the Permian epoch. Resemblances in the pelvic and scapular arch were pointed out. The quadrate bone was discussed, referring to the theory of Albrecht. The genus Clepsydrops shows that it has the mammalian number of bones in its tarsus, and the resemblance was nearest to that found in the Platypus anatinus.

Dr. C. H. Merriam gave a paper on the hood of the hooded seal (Cystophora cristata); describing it as an inflatable proboscis overhanging the mouth, and extending posteriorly to a point behind the two eyes, lined with nasal mucous membrane, and divided longitudinally by two cartilages. It is not noticeable until the male has reached its fourth year.

In a paper on some points in the development of pelagic teleostean eggs, Mr. G. Brook, jun., first considered non-pelagic eggs; instancing those of trout, in which the hypoblast originates as an involution of the lower layer upon itself, the space between the

layers being quite distinct. In pelagic eggs the process is quite different. Sections of the eggs of Trachinus vipara at this stage show that the parablast of Klein, the intermediate layer of American authors, is made up of a large number of free cells, and nuclei are absorbed from the yolk, which contribute to a very great extent to build up the hypoblast. In this case, there is no true invagination. In Motella mustella the origin of the hypoblast is similar to that of Trachinus; but the resulting cells, instead of being quite similar to the original ones as usual in teleostean eggs, are very much larger, and hexagonal, so that they cannot be derived directly from the lower layer of cells. The author sustained the views of Ryder as regards the segmentation cavity in pelagic eggs. He also holds that there is no circulation in pelagic embryos before hatching.

Mr. G. Macloskie, in his paper on the dynamics of the insect crust, commenced with a general description of the chitinous skeleton with its in- and outgrowths, etc. The tracheae have spiral crenulations, which have been hitherto misunderstood and supposed to be threads; these tracheae transmit gases directly to the tissues, and the blood is not used for this purpose. The tracheae are not directly controlled by muscles; their action depending on the successive production of a partial vacuum, and condensation of air around them.

Prof. A. Hyatt read a paper on the larval theory of the origin of tissue, stating that the building-up of the tissues of the metazoa is due to a quick and rapid division of cells. Minot's theory that the origin of the sexes is due to the difference in cell elements was supported. The author considered the planula a more primitive form than the gastrula. In another paper Professor Hyatt presented objections to some commonly accepted views of heredity; asserting that heredity has no need of the gemmule hypothesis or pangenesis, but that it can be equally well understood upon the supposition that the nuclei of cells are the immediate agents of the transmission of characteristics. The author presented the case of a man in Maine who resembled the mother on one side of his body, and his father on the other side, as an illustration of his theory; and he contested the position of Professor Brooks as regards heredity. In a paper on the structure and affinities of Beatricea, the same author stated that this fossil has had many positions assigned to it in almost all the groups of the Invertebrata, though he himself now thought it a foraminifer. Thin sections were examined, the structure being found to consist of cells joined by a stolon.

Dr. C. S. Minot presented a paper on the skin of insects. The skin consists of three layers, — externally the cuticula, overlying an epithelium, which lies in turn on a sheet of connective tissue; the epithelium, homologous with the epithelium of other animals, and which should be so called instead of hypodermis; and dermis, which name should be applied to the connective tissue, as it is the homologue of that of vertebrates. The cuticula of caterpillars has not yet been fully described: it consists of two layers, a thick one and a thin one.

In a communication on the development of Limulus, Mr. J. S. Kingsley stated that his account begins after the formation of the blastoderm. At this time there is a single layer of cells surrounding the yolk, in which are scattered nuclei. The mesoblast arises as a single sheet on the ventral surface. Its cells come largely from the blastoderm, but some arise from the yolk nuclei. The mesoblast soon forms two longitudinal layers, one on each side in the neighborhood of the limbs. The coelom is formed by a splitting of the mesoblast, and at first consists of a series of metameric cavities extending into the limbs. The supraoesophageal ganglion arises by an invagination of the epiblast. The heart arises as two tubes in the somatophore, which later unite. The mesenteron does not appear until after hatching. The amnion of Packard is the first larval cuticle, and bears a resemblance to the amnion of the tracheata. A second cuticle is formed and moulted before hatching. The eyes appear on the dorsal surface at the same time that the limbs appear on the ventral. In these characters Limulus agrees essentially with the tracheata, and has nothing in common with crustacea.

Prof. B. G. Wilder, in a paper entitled, 'Do the cerebellum and oblongata represent two encephalic segments, or only one?' remarked that most writers had considered two segments to exist. The cephalad of these segments is held to include the cerebellum, together with the portion of the 'brain-stem' immediately connected therewith and the latter part of the oblongata. The only writers that have admitted of a single segment caudad of the mesen are Balfour, A. M. Marshall, Owen, and Spitzka. The views of Spitzka were then discussed; concluding with the opinion that sufficient evidence to settle the question was wanting.

Dr. J. A. Ryder presented a paper on the morphology and evolution of the tail of osseous fishes. The caudal fin of fishes is developed in the same way as the other median or unpaired fins, from a median fin-fold. After the protocercal stage of the larva is passed, a lower caudal lobe grows out, which is probably the homologue of a second anal fin. The hypotheses which grow out of a consideration of the facts of the development of the tails of fishes, are the following: 1. Whenever heterocercality manifests itself, there is a more or less extensive degeneration of the caudal end of the chordal axis, which began to be somewhat manifest far back in the phylum in such forms as Holocephali, Dipnoi, and crossopterygians. 2. With the outgrowth of the lower lobes (second anal) the energy of growth tended to push the tip of the chorda upward; the lobe itself arising, probably in consequence of the localization of the energy of growth and the deposit of organic material at the point according to the demands of use and effort. 3. Local use and effort, acting as constant stimuli of local growth, carried the heterocercal condition and its accompanying modification of degeneration and reduction still farther, as is shown by a study of the homologous elements in the tails of fishes; while use and effort would also continue to augment heterocercality, until the inferior and superior lobes were

about of the same length and area, when the morphological characters of the caudal fin would become approximately stable for any one species, as may be shown by measurements of a simple mechanical illustration, in which the interaction and composition of the forces which are brought into action are demonstrated. 4. The mechanical demonstration alluded to above, taken together with the fact that the primitive or ancestral form of the tail, which is typified by a temporary condition in fish larvae, when the myosomata are rudimentary, but still symmetrical, amounts almost to a demonstration of the principles first laid down by Lamarck, then elaborated by Spencer, and more recently applied to special cases by the author and Professor Cope.

In a communication on growth and death, Dr. C. S. Minot gave the results of ten thousand measurements of weight of growing guinea-pigs and other animals from birth to maturity. The rate of growth was found to steadily diminish from birth onward; so that the loss of power begins at once, and continues until death. The common views of death were discussed, and the current conceptions of animal individuality were attacked. The author then referred to the bearing of our present knowledge of senescence upon the theory of life, and the relation of life to a material substratum.

A paper on the osteology of Oreodon was read by Mr. W. B. Scott, in which this genus was said to belong to the Artiodactyla, although there are some strong resemblances to the Suidae. Vertebrae are ruminant, markedly in the case of the axis. Thoracic vertebrae have long prominent spines, and small bodies slightly amphicoelous. Lumbars, probably five in number, are heavy, with short spines and broad flat transverse processes. Sacrum contains two vertebrae which touch the ileum. The tail is long and slender, and the legs proportionally long. There are a short head and short metapodials, giving the animal a wolf-like appearance. The radius and ulna are distinct. The carpus consists of eight bones, including the pisiform. There are short unankylosed metacarpals. The ungual phalanges are long and pointed, as in Hyopotamus. A rudimentary pollex is present, this being the only artiodactyl with one.

Mr. J. Struthers, in a paper on finger-muscles in Megaptera longimana, and in other whales, records rudimentary flexor and extensor muscles in these animals, and shows that they are more or less used, as the muscular fibres are red and not degenerated.

Dr. G. M. Sternberg described his experimental research relating to the etiology of tuberculosis. The author repeated the inoculation experiments of Koch, with similar results. The experiments of Formad to induce tuberculosis in rabbits by introducing into the cavity of the abdomen finely powdered inorganic material, have also been repeated with entirely negative results. The author held that Koch's bacillus was an essential factor in the etiology of tuberculosis.

Dr. C. E. Bessey, in a paper on the adventitious inflorescence of Cuscuta glomerata, stated that the examination of young plants shows that the inflorescence is developed from numerous crowded adventitious buds, and not by the repeated branching of axillary flowering branches as commonly stated.

In a paper on the hitherto unknown mode of oviposition in the Carabidae, Prof. C. V. Riley records habits of Chlaenius impunctifrons, traced from the egg up. The eggs are laid singly in cells made of mud or clay, on the under surface of leaves.

Mrs. A. B. Blackwell read a paper on the comparative longevity of the sexes. The study was exhaustive, and made on statistics from all parts of the world; and the greater longevity of woman over man was established. In old countries the females preponderate, while males lead in newly settled ones. Up to eighteen years the males are in excess of the females: later the females predominate.

PROCEEDINGS OF THE SECTION OF HISTOLOGY AND MICROSCOPY.

THE attendance at this section was very small, partly because the other sections drew away not only many members, but many papers also; partly too, we imagine, because the American society of microscopists had held its annual meeting a short time previously. The future of this section is somewhat uncertain, especially because many of the members are unwilling to have their histological papers withdrawn from the section of biology. The abolition of the section was much discussed, not only among the members interested, but also in the section itself. As the number of communications and the attendance were both of the smallest, the feeling against the continuance of the section, with its separate organization and equal rank with the sections of physics, biology, geology, etc., became very decided with many of those most interested. Finally, Dr. C. S. Minot announced in general session, that he should bring up a motion to amend the constitution so that section G shall be abolished. This amendment will come up for consideration at the next meeting of the association.

Alexis A. Julien read a paper on an immersion apparatus for the determination of the temperature of the critical point in the fluid cavities of minerals. The extensive occurrence of carbon dioxide in minerals renders the determination of its critical point important; yet with the forms of apparatus hitherto described for this use, there have been sources of serious error. The author described a new device for raising a thin section of a mineral, mounted on a glass slide, to an accurately determinable temperature upon the stage of the microscope. The arrangement consists of a thin walled box heated by conduction from a taper through the copper plate which forms its bottom, and which projects beyond the stage. The thermometer has a scale ranging from 22° to 45° C.; each degree on the scale being two centimetres in length, and divided into tenths. The bore and length are so arranged as to bring that part of the scale near 30° on a level with the eye at the eye-piece, in order

to facilitate quick readings without moving the head. The box serves as a water-bath in which any objective from one-half to one-tenth may be immersed without serious loss to the objective's optical capacity. The critical point of the fluid may be readily determined in ten minutes by both the disappearance and reappearance of the bubble within a twentieth of a degree. For further details the author referred to his earlier paper upon an apparatus for this purpose.

Dr. Theobald Smith presented an account of Salmon's culture-tubes; but as it has not yet been revised by Dr. Salmon, we postpone notice of it.

Prof. Henry F. Osborn's paper upon a microscopic method of studying the amphibian brain was valuable. The brain is hardened in 'Müller's fluid,' the ventricles being fully injected. After the usual alcoholic treatment, the brain is placed for one week in a carmine solution, then for twenty-four hours in acetic acid. The embedding mass is prepared by shaking the contents of an egg with three drops of glycerine. After soaking in this mass, the brain is placed in position, and hardened in the vapor of boiling eighty-per-cent alcohol. The mass is then placed for one week in absolute alcohol. Section is made under alcohol with a Jung's microtome. The sections on the slide are arranged, covered with old-fashioned blotting-paper (cigarette-paper was suggested as better by Dr. C. S. Minot), and treated with alcohol and oil of cloves through the paper, a device which may prove convenient in many cases.

Dr. H. G. Beyer reported one of his observations made during his still uncompleted researches on Lingula. In his abstract he says, "One of the points that I should like to demonstrate from one of my sections is a probable communication of the so-called segmental tubes with one of the diverticula (liver) of the alimentary canal of the animal, by means of a convoluted tubule;" certainly an important observation if verified.

Dr. R. H. Ward described a couple of neat contrivances, — one, a new illuminating arrangement called the iris illuminator; the other, a long-armed lens-holder. Prof. William A. Rogers gave a description of the various steps by which a centimetre or an inch may be produced from a standard metre or a standard yard respectively.

The remaining papers contained almost no new original matter, but were chiefly accounts of methods or apparatus well known to professional workers.

PROCEEDINGS OF THE SECTION OF ANTHROPOLOGY.

THURSDAY forenoon was occupied by the general meeting, leaving only time for the organization of the sections. In the afternoon the address of the vice-president, Prof. E. S. Morse, was delivered to a very attentive and interested audience. As we have already given this address in abstract, no analysis need be added here.

The real work of the section began on Friday morning, with a paper by Rev. S. D. Peet, upon emblematic mounds, their uses and purposes. The author, having carefully studied many of the mounds, has reached the conclusion that from them much may be learned as to the symbolism of the people who made them, and through this of the people themselves. He thinks that certain animal forms were used for specific localities. For example, turtle mounds were placed upon high ground where a lookout would be stationed; eagle mounds, near bluffs; panther mounds stood guard over village sites. He believes that the mounds indicate the totems of the tribe which made them. The paper was illustrated by charts, and was followed by an extended discussion. Many of the archeologists present were evidently unable to identify some of Mr. Peet's mounds, as represented in his diagrams, with known animals, so confidently as he did; and some of the outlines seemed quite unlike those of any animal, though of most the animal form was evident. The discussion soon turned upon symbolism in general. Mr. La Fléche, an Omaha Indian, and member of the section, spoke of some of the symbols common among his people. Dr. Syle of China referred to similar symbols common among the Japanese and Chinese, and noticed the very remarkable resemblance which existed between current symbols in eastern Asia and western America. Dr. E. B. Tylor spoke of the totem system as wide spread, being found not only in North America, but as well in South America, Micronesia, and among the hill tribes of India.

Then came a paper by Miss A. C. Fletcher, upon child-life among the Omahas. It was such an account as only one who had lived among the people, and with hearty sympathy entered into their daily lives, could have given; and the earnest, clear, tender treatment of the subject was most delightful. We were told how, when ten days old, the child received a sacred name given with impressive ceremonies; how its cradle was prepared, and how lovingly the little one was tended, often by father as well as mother. This cradle is a flat board, to which the child, laid on its back, is swathed; the bandages for girls being different from those used for boys. Because of this treatment, most Indians exhibit a peculiar flattening of the occiput. The child is not kept constantly on the board, but at times is allowed to kick about at will; and after the sixth month it is rarely used, a hammock then taking its place. The crying of the child seems very unpleasant to them, and if it occur they use every means to quiet it. When the child is three years old, the solemn ceremony of cutting its hair generally takes place, though all the children do not receive this. Before this, the hair is allowed to grow. At this time, if the parents desire, a new name may be given to the child. Each gens has its own style according to which the hair is cut. The home life of Omaha children was shown to be pleasant and joyous, and the child is very much attached to it. Toys, games, and story-telling abound. After early childhood has passed, various duties are assigned to the children, — to the boys, the care of the ponies, the use of the bow and arrow, etc.; to the girls, the care of younger children, and later tilling the ground, dressing skins, and cooking, and until a girl is profi-

cient in all these things she is not regarded as fit for marriage, which occurs when she is about twenty. At the conclusion of the paper, which Dr. Tylor called 'most tantalizing,' many questions were asked, and in response to these many additional facts were given. That great respect for woman prevailed among the Omahas, was emphatically asserted by Miss Fletcher. Articles of taboo were common; each gens having a certain group of objects which must not, on any account, be touched. Dreams play a very important part in an Indian's life: to him, dreams are as real as any part of the actual world about him. Mrs. Smith spoke of a custom among the Iroquois, of placing near the mouth of the dead baby when buried a cloth saturated with the mother's milk. Friday afternoon's reading began with a paper by Miss F. E. Babbitt, describing certain very rude quartz objects found *in situ* in undisturbed gravel-banks in central Minnesota. Dr. Abbott, in connection with this paper, described and exhibited some of the objects found by him in the Trenton gravels. In the next paper, Rev. S. D. Peet endeavored to show the importance of a study of the architecture of prehistoric nations as a means of discovering their degree of civilization, and subdividing the stages of progress.

A much-neglected and yet not unimportant department of ethnology was brought before the section in a paper by Mr. A. W. Butler, on local weather-lore, in which he presented a collection of sayings respecting the weather, current in southern Indiana, excluding all that are of more wide-spread use. The last paper of the afternoon, by Mr. A. E. Douglass, described in a very complete manner some of the mounds of the Atlantic coast of Florida which the author had explored. Both shell and earth mounds are found quite evenly distributed along the coast from the mouth of the St. John's River to the southern part of Lake North. The shell mounds are for the most part situated upon narrow strips of land which separate the numerous lagoons from the sea. Some are of great size: one shell ridge is eight miles long; and one mound, which covered three acres, was made up entirely of the little shells of Donax variabilis. These large mounds were constructed at different times. The earth mounds occur inland. Two of the mounds are composed wholly of bits of rock; and one large mound has, three feet below the surface, a pavement of stone which extends entirely across it. Implements and other objects are often found in the mounds of the St. John's River, but not in the more southern mounds. Mr. Douglass's account was quite detailed, and a very interesting and valuable addition to our knowledge of the subject.

On Monday morning the section first listened to a paper by Mrs. Erminnie A. Smith, on disputed points concerning Iroquois pronouns. She spoke of the peculiar difficulties which arose from the manner in which the pronouns were used in Iroquois, — some of them being arbitrarily used; different words sometimes requiring unlike pronouns for the same person and number; and there were other peculiarities which had misled students of the language. Another difficulty and source of error was found in the use of gender. The early writers recognized but two genders, a noble and an ignoble; while the author had found three, as in English. Some of the pronouns, as that of the third person, answering to our 'he, she, it,' are always incorporated; while others, as indeterminate pronouns, are always expressed independently. The grammar of Père Marcoux was criticised by the author, and certain errors pointed out. Dr. Tylor remarked, in connection with this paper, upon the importance of studying the treatment of gender in any savage language with great care. Not all peoples recognize the division of living or other objects into male, female, and neuter. The Zulus have many classes, or genera, into one or another of which any given object falls; but they do not make any distinction of male and female. Miss Fletcher said that among the Sioux the same pronoun was used for both sexes, the gender being determined by the context.

A very long and extremely interesting account was then given by Mr. F. W. Putnam, of the explorations which he and Dr. Metz had carried on under the auspices of the Peabody museum at Cambridge. These investigations had been chiefly devoted to the study of a group of mounds near Madisonville, Ind., known as the Turner group. The very careful manner in which the exploration of the mounds had been carried on — the earth taken away and examined shovelful by shovelful — was shown, and the results of the work enumerated and illustrated by diagrams and photographs in great number. Neither time, labor, nor money had been spared in the prosecution of the work; and as a result one of the most remarkable series of objects ever discovered in America had been obtained, and also many new facts respecting the structure of the mounds themselves. For example, it was found that in stratified mounds the layers were always horizontal, not, as usually represented, curved. Singular ash-pits, masses of burned clay, layers of stones, and other features were mentioned and illustrated. Among the objects taken from the largest mound of the group were the following, some of them never found before in the mounds: shell beads, disks, and rings, which were obtained in thousands; cones cut from alligator-teeth; ornaments cut from plates of buffalo-horn, mica, and native copper; objects of native silver, and even gold, and meteoric iron; pearls, most of them pierced, and injured by heat (not less than fifty thousand of these were found); small stone dishes beautifully carved to represent some animal form; and last, and perhaps most important, terra-cotta figurines of exceedingly artistic form, and strangely Egyptian in character. These objects, it should be noted, are all of an ornamental character: no other sort was found in this mound. A brief paper by Miss C. A. Studley described some of the crania from this mound, and others near it.

In the next paper, Dr. P. R. Hoy showed how grooved stone axes and similar implements could be manufactured by the use of a common hammer-stone, and showed specimens that had been so made by a friend. The specimens, which Dr. Hoy asserted

were made without great labor, were certainly dangerous counterfeits, such as might readily be passed off as genuine. Mr. Putnam remarked, after Dr. Hoy had finished, that many counterfeits were now manufactured, and that they might be found in almost every large collection, and he had knowledge of one shipment of two thousand of these frauds to England.

Following this was a paper by Major Powell, on the mythology of the Wintuns, a people living in the Sacramento valley. Many curious myths collected among this people by the author were given, but an abstract of such a paper is hardly possible. A few of the beliefs of this tribe may, however, be given. They believe in three worlds, and that each has its peculiar class of inhabitants. The sky is smoke. (Other — and the majority of — Indians believe that it is ice, as snow and hail show, and rain is the same melted; while a few think it quartz crystal.) Mountains were made by the burrowing of the mole-god. Light and darkness are maiden goddesses. Rocks and other inanimate things were once living, and some rocks now live and speak; and this is the Wintun explanation of echoes. Whirlwinds are little spirits seeking water to drink. Diseases are caused by mythical animals. The 'tar baby' of the negroes of the south appears in some form in the mythology of not less than fifty tribes of Indians; and other bits of negro folk-lore are also found among the Indians, from whom the slaves must have obtained them. Dr. W. H. Dall then read a paper on the use of labrets, its title being 'The geographical distribution of labretifery.' He described labrets of different sorts, and the mode in which they were worn. The extent of the custom over the continent was also noticed, and the fact that it is less prevalent now than formerly. The great size of some of the labrets worn was mentioned.

Tuesday morning marked an epoch in the history of the section, because of the very thrilling and vivid account and exhibition of the sacred pipes of friendship used by the Omahas. The pipes themselves are held in such reverence by the Indians, that they are never allowed to leave the tribe, and those shown the audience were the first ever taken away; and the ceremonies described and illustrated had never before been presented to an audience of white men. Moreover, it was extremely interesting to hear a full-blooded Indian explaining in clear, well-chosen sentences, some of the most sacred mysteries of his tribe to an audience of anthropologists. Mr. La Fléche first described the pipes, and how they were made, — the stem of ash, seven spans long, decorated with certain feathers of the owl, woodpecker, eagle, and duck, and with hair from the breast of the rabbit, and streamers of horse-hair dyed red. The stem was painted green, and grooved by narrow straight grooves; and, when the two pipes are in place, they rest upon a wildcat-skin at one end, while the other is supported by a crotched stick, and under them are two gourd rattles which are shaken in accompaniment to the song, or chant, sung when the pipes are taken up and waved to and fro as they are during the ceremony. After Mr. La Fléche had given his paper, Miss Fletcher continued the account, showing how strong the tie of friendship formed in the presence of the pipes is, — stronger even than ties of blood; and that in their presence no anger or ill-will could have place, but all must be peace and harmony. She spoke of the miraculous power attributed to the pipes by the Indians. The stem was of ash, because that and the cedar were the two sacred trees; the ash being associated with that which is good, and the cedar with that which is bad. With deep pathos she described the ceremony which took place when the pipes were given to her to bring away, and explained that it was only because of their profound gratitude to her for securing their lands to them from the government, that this mark of their great confidence and esteem was bestowed upon her by the Omahas. No account can justly describe the character of this joint paper. It was constantly illustrated by reference to the sacred objects exhibited, and afforded those who heard it a most vivid and intensely interesting insight into the hidden mysteries of Indian life and character.

Following this was a very instructive paper by Prof. E. S. Morse, giving some of the results of extended interviews with a Korean. Many interesting facts respecting this little-known people were given. The author spoke of the great filial obedience and devotion of the sons, the secluded position of women, the system of serfs; the law forbidding all except the king from decorating the exterior of their houses, or having any other than rectangular openings for doors or windows. The bride and groom never see each other before marriage. There is a general tendency to indolence. Strangely, a horse-shoe is a sign of good luck. Their games are numerous, and some of them intricate. Many of the superstitions of the Koreans were given.

After this, Dr. Tylor spoke upon North-American races and civilization. He alluded to the wonderful resemblance of our North-American tribes to Mongolian peoples, — a resemblance suggesting at once, not an indigenous origin for the Indian tribes, but a migration from Asia across Bering Strait. The greatest objection to this view is found in the very great diversity in the languages of the American nations. This leads to an examination of the evidences of the antiquity of man upon this continent; for, unless we can prove an antiquity sufficiently remote to allow time for the strange diversity of tongues to have occurred, our perplexity is great. While there is this diversity of language, there is great similarity in the social condition. The matriarchal system (descent, etc., through the mother, not the father) is universally prevalent.

A most thoughtful and able paper was then read by Major Powell, on three culture periods, — savagery, barbarism, and civilization. The evolution of man was dwelt upon very earnestly by the speaker. He very emphatically, and almost indignantly, expressed his belief that man's evolution never is nor can be a struggle for existence. Man does not change with change of environment; he changes, and adapts his environment to himself. The struggle has been

removed from man to his activities. Man progresses, not by struggling for existence, but by means of his pursuit of happiness. Animals live each for itself: man cannot live for himself alone. When animals were domesticated, a great step in advance was taken. By this means, and by the introduction of agriculture, the gens was broken up, and the matriarchal system changed to a patriarchal. Another great step was taken when metallurgical processes were discovered; then civilization was reached. Owing to the lateness of the hour, Major Powell omitted a large part of his most interesting paper. Speaking, as he did, with the earnestness of intense conviction, he bore his audience from argument to argument in a masterly manner; and many warm expressions of approval were bestowed upon the author.

The opening paper on Wednesday morning, by Mrs. Erminnie Smith, discussed in a very original manner the formation of Iroquois words. She very pertinently called attention to the fact, that most students of Iroquois had contented themselves with collating lists of words, while the more thorough and useful method would involve a search for roots by analyzing words; and the author had proceeded in this way, and as a result made many curious discoveries. Certain errors in dictionaries of the language were pointed out. The Tuscarora language, she thinks, affords a key to the dialects of the other six nations. Examples illustrating the formation and origin of many words were given. The literal meaning of many words in common use is very curious: for example, tears are, literally, eye-juice; whiskey, deformed water; agony, he eats up his life; a bank is a money-farm, — the principal is the mother, and the interest the baby. Birds are often named from their note, other animals from some physical peculiarity.

Following this was a long and most instructive paper by Dr. A. Graham Bell, upon a race of deaf-mutes in North America. Mr. Bell first called attention to the increasing prevalence of deaf-mutes in the United States. He showed that the increase of deaf-mutes was very much greater relatively than that of other classes. In order to open his argument, he asked the question, 'How can we in the most scientific manner establish a race of deaf-mutes?' In answer to this question, he showed that no more efficient means for the formation of such a race could be set in action than just those which, from the best of motives, philanthropy had used and was still using for the benefit (?) of these unfortunate people. The system of secluding deaf-mutes, so that they associated only with each other; teaching them a special language, so that they learn to think, not in English, but in a language as distinct from it as French or German, and thus lose largely their use of English, and cannot express themselves well in written English, — all this he strongly deprecated. He spoke of erroneous ideas respecting the deaf and dumb, which are more or less prevalent. In the education of deaf-mutes, Mr. Bell would follow a different course from that usually pursued. He would have this class of children educated in the constant company of children who can hear and speak, not reciting in the same classes, except in map-drawing and such subjects, but in rooms by themselves, and yet mingling with other children as much as possible. He would have deaf children learn to understand what was said to them, by watching the motion of the lips. He would, so far as might properly be done, discourage intermarriage between deaf-mutes. He would have all deaf-mutes taught articulation; for, only by making the attempt, can it be known who can and who cannot speak. Professor Gordon of the Deaf-mute college in Washington spoke at some length upon the subject of Dr. Bell's paper, agreeing with the author in many important points, but disagreeing with him in others. He thought the deaf-mutes less isolated, and the danger of forming an increasing race very much less, than did Professor Bell. He also strongly advocated the use of the sign language, at least in elementary classes: when older, the vernacular may well be used.

The first paper of the afternoon was by Rev. S. D. Peet, upon tribal and clan lines recognized among the emblematic mounds. Following this was a description of a hitherto undescribed sacrificial stone at San Juan Teotihuacan, by Mr. A. W. Butler. This is five feet and a half square at the top, and six feet high, very elegantly carved, the bulk of the stone being occupied by a gigantic human head. The closing papers were by Prof. E. S. Morse, who added still further to the already great mass of information which he has given us respecting the Japanese. The first paper, on archery in Japan, gave accounts of methods of arrow release and the use of the bow, giving many interesting facts. In his second paper, on the use of the plough in Japan, Professor Horse showed some of the forms of plough seen in Japan, and the manner in which they were used.

Thus closed a meeting which all the members of the section agreed had been one of the most successful ever held. The papers were, many of them, of great weight and permanent value, and must form a part of the standard literature of American ethnology and archeology. The discussions were especially notable because of the presence of eminent English anthropologists, as Dr. Tylor, Dr. Syle, and others, who freely took part, and added their store of facts and enthusiasm. Not only were professional anthropologists greatly delighted and stimulated by the series of meetings; but the large audiences which, in spite of the very great heat, daily gathered in the room assigned to section H, showed quite conclusively that some, at least, of the papers were of general interest.

PROCEEDINGS OF THE SECTION OF ECONOMIC SCIENCE AND STATISTICS.

THE section met in the hall of the Historical society of Pennsylvania, Thursday morning, Sept. 4. Gen. John Eaton, commissioner of education, was vice-president; and Charles W. Smiley of the U. S. fish-commission, secretary. On and after Monday, Hon. Lewis H. Steiner of Frederick City, Md., acted as chairman of the section, Gen. Eaton having been

called away. The address of Gen. Eaton upon scientific methods and scientific knowledge in common affairs was well received by an audience of about fifty persons. Some of the more interesting papers were the following: —

Prof. E. B. Elliott read a paper on the credit of the United-States Government, and presented tables and formulas. He said that the credit of the government had been continually increasing, as shown by the reduced rate of interest required; the rate of interest realized to investors in the four and a half per cents having been but about 2.7 per cent during the past four months.

Miss Alice C. Fletcher of the Peabody museum presented a paper on lands in severalty to Indians, illustrated by experiences with the Omaha tribe. She spoke of the Indians' ideas of land and property; of the agriculture of the Omahas, their reservation, their uneasiness upon the land tenure of Indians, and the desirability of securing to them land in severalty. The Indian question was discussed by Dr. Steiner, Mr. Spencer Borden, Mr. T. B. Browning, and others.

Mr. J. B. Martin of London read a paper upon the future of the United States; this, being from an English point of view, was very interesting. He called attention to the rapidity with which the public lands are being taken up, and to the rapid increase in population, which he thinks will soon reach seventy-five millions. How shall this population be fed? With the lands all taken up, and with cultivation brought up to a par with the improved agriculture of England, he estimated the surplus to suffice for thirty-five millions. The development of American agriculture will have to depend on foreign markets for its products; and, as the experience of England and America has been that food-supply is regulative of population, it may be assumed that Great Britain will long supply a market for cheap American food-products. But, meanwhile, the urban population is growing relatively to the country population; and this fact may be expected to exercise a retarding influence on the development of agriculture. The condition of the public debt was remarked upon as without parallel elsewhere. The debt charge has decreased to one-fifth the public revenue, while that of Great Britain is one-third the total revenue. With a debt entirely manageable, and with charges for naval and military purposes merely nominal, the nation will be able to develop itself under the most favorable conditions ever witnessed in the world. But the opportunity for capitalists to invest in public bonds failing, and the exceedingly low rate of interest, he regarded as ominous, and as likely to produce low wages, low prices generally, cheaper raw material, cheaper production, and close competition. The impossibility of spending the national revenue will cause a reduction of customs duties. With increase of population, and diffusion of wealth, the accumulation of individual fortunes will become more difficult, 'corners' less frequent, and time be found for literature, science, and art. He anticipates a gradual federation of state rights, increased intercommunication, perpetual shifting of population from state to state, — all tending to a complete amalgamation in one federal republic.

Mr. Thomas Hampson of the bureau of education read a paper on the apprenticeship question and industrial schools. He maintained that the apprenticeship system does not provide an adequate supply of workmen, and that it cannot be modified so as to do so. He, therefore, would substitute scientific for literary studies in the common schools, and establish manual-labor schools everywhere. Mr. C. M. Woodward, principal of the St. Louis manual training-school, gave a full account of that institution, which had been exceedingly useful thus far. Mr. Spencer Borden, owner of a bleachery at Fall River, Mass., encouraged the proposition; saying that he had become dependent upon foreigners for foremen of his factory, much against his wishes. The discussion showed much sympathy with the plan, though very little for labor-industrial schools, the latter tending to speculation upon the work of the pupils.

Professor W. O. Atwater of Wesleyan university read a paper on percentages and costs of nutrients in foods, which elicited great interest. Of the different nutrients, protein is physiologically the most important, as it is pecuniarily the most expensive. Among the animal foods, those which rank as delicacies are the costliest. The protein in oysters costs from two to three dollars, and in salmon nearly six dollars, per pound; in beef, mutton, and pork, it varies from 108 to 48 cents; in shad, blue-fish, haddock, and halibut, about the same; while in cod and mackerel, it ranges from 67 to as low as 33 cents per pound. Salt cod and salt mackerel are nearly always, fresh cod and mackerel often, and even the choicer fish as blue-fish and shad, when abundant, cheaper sources of protein than any but the inferior kinds of meat. With the larger proportions of both refuse and water, the proportions of nutrients, though variable, are usually much less than in meats. Thus a sample of flounder contained 67 per cent of refuse, 28 of water, and only 5 per cent of nutritive substance; while the salmon averaged 23, the salt cod 22, and the salt mackerel 36, per cent of nutrients. The nutrients in meats ranged from 30 per cent in beef to 46 in mutton and 87½ in very fat pork. Canned fish compare very favorably with meats. Vegetable foods have generally less water and more nutrients than animal foods. Ordinary flour, meal, etc., contain from 85 to 90 per cent or more of nutritive material; but the nutritive value is not proportional to the quantity of nutrients, because the vegetable foods consist mostly of carbo-hydrates, starch, sugar, cellulose, etc., of inferior nutritive effect, and because their protein is less digestible than that of animal foods. Potatoes contain a large amount of water and extremely little protein or fats.

Prof. J. W. Chickering, jun., and Prof. J. C. Gordon of the National deaf-mute college, Washington, read papers upon the condition of deaf-mutes and deaf-mute instruction. Deaf-mutes average 1 in 1,500 of the world's population. In the United States there were 33,878 reported by the last census. Over 15,000 have received an education, and are engaged in the

ordinary pursuits of life, 12,000 are of school age, and from 1,000 to 2,000 are uneducated adults. There are fifty-eight schools and one college, for this class, in this country. The usefulness of the educated and the pitiful condition of the uneducated were described by Professor Chickering. Professor Gordon maintained, in opposition to the views of Dr. A. Graham Bell, that the complete education of those born deaf demands social knowledge, special training, and special methods which are not possible in common schools; while the literal co-education of those born deaf, with hearing children, is an admitted impossibility. Deaf children prepared by special instruction to join regular classes in common schools without detriment to themselves, or to their classmates, do not need common-school instruction, having incidentally accomplished the work of the common school in gaining this mastery of language. The advantages of association with hearing children in the public schools are largely illusory, the environment being substantially the same as that of all deaf children before leaving their families to enter special institutions. Parents and public-school teachers can readily qualify themselves to render valuable help to deaf-mutes by beginning their education, and supplying, as far as possible, the training corresponding to the material education of infants and the earlier part of the work of kindergarten and infant schools. No satisfactory plan has ever been found for supplying deaf classes, in public schools, with teachers having the special fitness, knowledge, and training requisite for the satisfactory education of those born deaf. Special institutions remain a necessity for the great majority of deaf children; and they show superior results with the greatest economy of time, money, and men, irrespective of method, system, or devices of instruction.

Mr. William Kent of New York read a paper on irregularity in railroad-building as a chief cause of recent business depressions, which he supported with statistics and diagrams. He proved some remarkable coincidences during four periods from 1860 to 1883, 1869 to 1873 and 1879 to 1883 having been periods of great activity in railroad-building. The paper was discussed by Mr. Loren Blodget of Philadelphia, Mr. James H. Kellogg of Troy, N.Y., Mr. J. R. Dodge, and Mr. E. T. Peters. It was not generally conceded that cause and effect had been proven. Mr. Blodget referred to similar irregularities in English rates of interest, and Mr. Dodge to similar irregularities in cereals produced. In 1873 and 1874 these fell off six hundred millions of bushels, and the price rose from forty to sixty-four cents.

Mr. P. H. Dudley described his dynagraph and track-inspection car, and many members visited the car at West Philadelphia. This is one of the greatest of the many recent inventions for the safety of the travelling public.

Mr. L. A. Smith of Washington pointed out the advantages of great expositions to consist in 1°. stimulating the development of material resources, 2°. the introduction of profitable industries, 3°. the improvement of manufactures, 4°. the increase of trade, 5°. the founding of institutions, 6°. the social development of the people, 7°. advancement of science, and 8°. the promotion of technical education.

Don Arturo de Marcoartu of Madrid spoke upon the commercial relations of the United States with Spain and her colonies. He showed the meagreness of the present trade, and urged the importance of a treaty which should increase it. A line of steamers from Vigo or Lisbon to Boston or Baltimore is needed. The Umbria could make the voyage in six days. He desires to see the tariffs arranged so as to allow the exportation all over the Spanish territory of the American cereals, bread, coal, wood, cattle, and meats, and some other products wanted by the Spanish colonies; and to allow at the same time, on the other hand, the importation into the American union of wines, spirits, molasses, sugar, fruits, salt, and other Spanish products required in the United States.

Mr. George F. Kunz of Tiffany & Co. read a valuable paper on the American pearl, describing its form, color, lustre, and giving a list of the important 'finds.' He estimated the yield from 1881 to 1884 at $17,500 worth.

Dr. Charles Warren, statistician of the U. S. bureau of education, read a paper on the learned professions and the public, 1870–1880. Deriving the number of persons engaged in law, medicine, and divinity, from the occupation tables of the census, he showed that the rate of increase for each profession during the decade was much greater than the rate of increase in the general population. He commented upon the marked increase in the number of clergymen of foreign birth, and the great increase in lawyers, particularly in states situated north of the Potomac and Ohio rivers. Admitting that the number of clergymen is within the control of the sects purely, and not subject to legal interference, he observed that there is precedent for considering lawyers as officers of the state, and eminent propriety in making physicians also unpaid state officers. When this is done, the qualifications will be under state control, and indirectly the supply can be limited to actual needs. In 1880 he believes there was a surplus of sixty-four thousand in these three professions, and that decisive measures should be taken to remedy it.

Mr. Smiley of the U. S. fish-commission illustrated what is doing by the government in fish-culture, by presenting tables illustrative of the California salmon-work. An average of 2,500,000 young were deposited in the McCloud River from 1873 to 1883. The average annual catch has increased, since propagation began, by 4,391,882 pounds. This increase is worth, as it comes from the water, $313,700 annually. The annual cost of propagation is $3,600, leaving a net profit of $310,100 annually.

The sessions were all well attended; the number of persons in attendance frequently reaching fifty, and on a few occasions seventy-five. The popular character of the subjects induced this, and also induced the local press to give of this section much fuller reports than it gave of any other. The section has improved very materially since its organization at Montreal in 1882.